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EVALUATION OF MORTALITY IN SUGAR PINE RESERVOIR CAMPGROUND, FORESTHILL RANGER DISTRICT, TAHOE NATIONAL FOREST

Dave Schultz, Entomologist
John Kliejunas, Plant Pathologist

ABSTRACT

A campground is being constructed by a private firm under contract to the Bureau of Reclamation on the north shore of Sugar Pine Reservoir on the Foresthill Ranger District. Ponderosa pine mortality has occurred in the campground as a result of overstocking, stand disturbance and tree injuries which predisposed the trees to attack by western pine beetle, red turpentine beetle and pine engravers. Some additional mortality may occur in subsequent years as long as the predisposing factors remain. Additional stand entries before the trees recover from the shock of the initial construction could compound the stress and contribute to further mortality. Management alternatives discussed include: Do nothing, salvage dead trees immediately, control dwarf mistletoe, high-risk tree removal and sanitation, thin dense aggregations, protect trees with insecticide, treat slash, and treat stumps with borax.

INTRODUCTION

Sugar Pine Reservoir (T 15N, R 11E, Sec 18) is located on land administered by the Foresthill Ranger District. The reservoir was constructed by the Bureau of Reclamation to serve as a domestic water supply for the town of Foresthill. A campground is being constructed on the north shore of the reservoir by a private firm under contract to the Bureau of Reclamation. District Silviculturist Thomas Efird requested an evaluation of the campground construction area because ponderosa pine mortality was occurring. The area was evaluated by Dave Schultz , John Kliejunas and Tom Efird on October 26, 1983.

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OBSERVATIONS

There are two loops in the campground located on the north shore of the reservoir. The two loops are separated by the access road and an outcropping of serpentine. The serpentine area is about a Dunning Site IV and is sparsely stocked with manzanita, incense-cedar and Jeffrey pine. The Jeffrey pine is heavily infected with western dwarf mistletoe, Arceuthobium campylopodum. Dwarf mistletoe was not observed outside the serpentine area in ponderosa pine, which is its other potential host.

The vegetation in the loops in the east and west ends of the campground is similar. Ponderosa pine is the dominant species. There are scattered Douglas-fir, incense-cedar, white fir, madrone and deer brush. There is a mixture of age classes from saplings to old-growth sawtimber. The site index in the loops probably varies slightly because there are moist drainages and drier ridges, but overall is about a Dunning II. Stocking is generally heavy and ranges up to 450 sq. ft. basal area in some aggregations.

Most of the construction in the east loop is complete except for final paving of the loop and parking pads. Numerous tree roots were cut during excavation for roads, parking spurs, fire rings and toilet facilities. Some roots were covered with fill material. Many trees have bole injuries from construction machinery.

There were several groups of 5 to 10 dead pole-size ponderosa pine in the east loop. The dead trees showed evidence of attack by various combinations of pine engravers, Ips spp., western pine beetle, Dendroctonus brevicomis, and red turpentine beetle, Dendroctonus valens. A few large sapling and small pole-size ponderosa pine had only the tops killed by pine engravers. Pitch tubes produced by the red turpentine beetle were common on living trees, particularly those near construction activity. The crowns of some of the old-growth ponderosa pine had short, off-color foliage and dying twigs, which indicates relatively low vigor. No evidence of root disease was observed.

Construction was in progress in the west loop of the campground at the time it was examined. There was some damage to tree boles and some roots had been severed, but to a lesser degree than in the east loop. No dead trees or top kills were present. Several old-growth ponderosa pine and Douglas-fir showed crown symptoms of declining vigor.

DISCUSSION

The District does not have a clear record of exactly what happened during campground construction, or when events occurred, because both the physical construction and contract administration were handled by other parties. The pattern and age of the mortality, in addition to the species of insect involved, can be used to reconstruct the probable course of mortality in the campground. The older ponderosa pine mortality in the east loop indicates there was some top-killing by pine engravers in 1982. Pine engravers continued to kill tops and some small

pole-size trees in 1983. The red turpentine beetle attacked many injured trees and trees on disturbed sites during 1983, but these attacks caused little outright mortality. The ultimate cause of most of the current mortality was successful attacks by the western pine beetle during 1983. The mortality groups generally involved at least one tree that had been previously top-killed by pine engraver, heavily attacked by red turpentine beetle or severely damaged during construction. Western pine beetles attracted to pheromones released during successful attacks on the weakened trees caused localized group kills.

The high percentage of the mortality in the east loop which showed some degree of attack by pine engravers indicates that there was probably a local population buildup in green slash during 1982 and 1983. This suggests that some green pine slash created during the late winter or spring of those years remained untreated. The pine engraver population that emerges in spring is generally quite low. If ample breeding habitat in the form of green pine slash is available, the populations can build to damaging levels by midsummer. These conditions can be avoided in future projects by not creating pine slash during the critical period from about February through mid-July or by treating the slash. The slash would not present a hazard to that site if it was hauled off-site, or it could be made unsuitable for pine engraver breeding if all material larger than 3 inches in diameter was chipped or burned within about a month after cutting.

There should be some reduction in the level of mortality in the campground in 1984 because the major activities that generate slash or disturb trees are generally completed. A potential exists for additional mortality during 1984 and subsequent years because of the condition of individual trees and stands. Some of the campground trees suffered significant bole or root damage during construction. Some of these trees may not be desirable to retain in the campground because they are not capable of returning to full vigor or because the loss of support may make them hazardous.

It may be several years before injured trees which are desirable to retain recover enough vigor to withstand normal bark beetle pressure. There are also some remnant old growth trees in both campground loops which appear to have been declining for many years. The condition of the old-growth trees should be expected to continue to decline because of direct injuries from construction, altered drainages and competition from the surrounding younger trees. The high level of stocking that exists in most of the campground also contributes to the potential for further mortality. Above normal stocking increases competition for water and nutrients, which increases the susceptibility to bark beetle attack. Stress from overstocking is likely to be most severe to trees which are also in poor health due to other causes. Overstocking can also contribute to the possibility of group kills. Ponderosa pine is the predominant tree species in the campground and western pine beetle is likely to be involved in any future mortality. Pheromones released after a successful attack will draw other western pine beetles toward

the attacked tree. The influence of the pheromone will extend out about 20 feet from the tree under attack. The likelihood of additional trees being killed will be strongly influenced by the density of ponderosa pine in the vicinity of the initial tree under attack.

The probability of future tree mortality in the campground could be lowered by removing trees with chronically poor vigor and by thinning to improve vigor. Trees with chronically low vigor would include those with severe root or bole injuries from construction, suppressed and intermediate trees, and remnant old-growth trees which Keen's or Dunning's risk-rating systems identify as having poor vigor. Ponderosa pine with low vigor are the likely centers for future western pine beetle group kills. If the weak trees could be removed while they are green, it would offer some protection to the residual ponderosa pine within about a 20 foot radius.

Removing the high-risk trees would offer some benefits to the residual trees by acting as a light thinning. The area would probably still be stocked more densely than desired levels. The range of stocking levels that would support vigorous growth is around 160 to 220 square feet of basal area, depending on the average age of a given aggregation. Additional thinning would also offer an opportunity to shift the species composition toward a more pest-resistant and campground-hardy mixture. Many of the characteristics of ponderosa pine, such as thick bark which is resistant to wounding, and resinous wood which resists decay, make it a good species for campground use. However, the current high proportion of ponderosa pine in the campground makes the area extremely vulnerable to pests. The campground stands could be shifted toward a more mixed composition by favoring other suitable species instead of ponderosa pine during thinning. Other species present which have desirable features for campground use include incense-cedar, Douglas-fir, madrone and also native brush for use as screening or traffic control. White fir should not be favored in high-traffic areas because the thin bark is easily wounded, which often leads to root and butt decay.

Although thinning would eventually increase stand vigor in the campground, the effects would not be seen for several years. However, the physical disturbance of stand entry, sudden stand opening and further tree injury caused during thinning, would immediately stress some leave trees. The stress from thinning would tend to be additive with the stress from the initial construction. This leads to a dilemma because it may take several more years for the trees to recover from the stress caused by construction. Thus, thinning in the near future could contribute to mortality of the leave trees, but even greater mortality could occur if the only action taken is to delay the thinning for a few years.

The probability of ponderosa pine mortality could be lowered by temporarily protecting the trees with insecticide in conjunction with plans for thinning. One alternative would be to treat all of the ponderosa pine over about 4 inches diameter for a year or two, until they recover vigor, and then thin. This would involve treating some trees that would be removed later during thinning. The purpose would be to prevent the initial beetle attacks that would release pheromone and possibly attract enough beetles to overwhelm adjacent leave trees, even though they were

treated with insecticide. A second alternative would be to treat only the leave trees and then immediately thin the campground. This has the advantages of requiring less insecticide and effort, but it also carries a greater risk of mortality. The trees would not have an opportunity to regain vigor before being stressed again, and if there was any delay in starting and completing the thinning, beetles could attack the untreated ponderosa pine and spill over onto the leave trees.

MANAGEMENT ALTERNATIVES

1. Do Nothing. There will be additional mortality in the campground in 1984, but at a lower level than experienced in 1983. Mortality will generally center around severely injured trees and may involve small groups of trees. The mortality level should stabilize by 1985 or 1986, but the annual level may be higher than desired and a few campsites could be quite open by that point. High levels of stocking will keep the area susceptible to bark beetle attack. Future periods of additional stress such as drought will cause flare-ups of mortality.

2. Salvage dead trees immediately. The dead ponderosa pine in the campground were attacked by several species of beetles, some of which pose little threat to generally healthy trees. Several attack periods were represented and some trees were totally abandoned when examined. The western pine beetles which emerge in the campground will undergo a pre-attack flight and most will be well outside the campground limits before initiating an attack. Future mortality in the campground will probably be a result of attacks from beetles which emerge from scattered mortality outside the campground. Removing the dead, currently infested trees from the campground immediately has the potential to reduce mortality in 1984 by a small amount by removing the few western pine beetles that would emerge and remain in the campground. Any reduction may be more than offset, however, because stand entry and tree removal will cause some stress to the leave trees. If the campground trees have not recovered from the stress of the initial construction and if the stress of a second entry was additive, then salvaging the dead trees in the near future could contribute to mortality of leave trees. Salvaging the mortality probably would cause minor changes in the campground appearance, improve visitor safety, reduce the fuel load and increase returns to the Treasury.

3. Control dwarf mistletoe. Dwarf mistletoe is relatively isolated in the serpentine outcrop and is unlikely to reach the campground loops in the near future because of the buffer provided by the road and parking lot. A survey to delineate current extent of the dwarf mistletoe would indicate whether it indeed has not yet spread to the ponderosa pine. If it has, control measures are warranted to prevent further spread. Many of the Jeffrey pine are so heavily infected that pruning out the dwarf mistletoe would leave almost no crown. The area could be cleared and replanted, but it appears that there are microsite differences which are extremely important to survival and that growth is very slow, whether dwarf mistletoe is present or not.

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4. High-risk tree removal and sanitation. Ponderosa pine which were in a poor state of vigor prior to construction and those which were severely damaged during construction have a high probability of becoming future centers of western pine beetle group kills. The other ponderosa pine in the campground would derive some long-term protection if the high-risk and damaged trees were removed before they come under attack. Stand entry and tree removal will cause some stress to the leave trees. Removal of high-risk and damaged trees in the near future could contribute to mortality of leave trees if they have not recovered from the initial construction stress.

5. Thin overstocked aggregations. Thinning will eventually increase tree vigor and resistance to bark beetles. It will also promote the development of full crowns and root systems which would be desireable in a campground. Because portions of the campground are extremely overstocked, it would be appropriate to reduce the basal area by several light thinnings separated enough in time to allow the trees to recover between entries. If a thinning is attempted during or immediately after a period of stress such as the recent construction, it is likely to predispose the leave trees to bark beetle attack.

6. Protect trees with insecticide. Ponderosa pine can be given significant protection from western pine beetle attack for up to a year by a hydraulic application of Sevimol-4 or lindane to the lower 30 feet of bole during spring. The percentage of treated trees that survive would vary from about 80% to over 90% depending on the initial condition of the tree and its distance from a pheromone source. The treatment would not affect the likelihood of top-killing by engraver beetles on trees taller than about 30 feet. Treatment of the trees with insecticide could be used to prevent most mortality if silvicultural operations are deferred until stand vigor increases, or could be used on leave trees in conjunction with tree removal. When mixed with water according to manufacturers directions, both lindane and Sevimol-4 cost about $1.00 per gallon. Both materials are applied to the point of run-off, which is approximately 1 gallon per 50 square feet of bark. Applied to a height of 30 feet at the recommended rate, the total dose would be 1 gallon for a 6 inch dbh tree, 2 gallons for a 12 inch dbh tree and 3 gallons for a 20 inch dbh tree. Both lindane and Sevimol-4 are classified as Restricted Use Pesticides by the State of California.

7. Treat slash. Further top-killing of pines in the campground could be minimized by promptly treating fresh pine slash or storm breakage to make it unsuitable breeding habitat for pine engravers. Slash which is created from July through December has a lower probability of contributing to the buildup of local pine engraver populations to damaging levels than slash created at other times of the year. Scheduling thinning during the period of low hazard may, however, conflict with the season of high recreation demand. Slash hauled at least one-quarter mile away would present little hazard to the campground, but could contribute to localized pine mortality where it is dumped. Slash could be made unsuitable for breeding by burning or scorching within a month after it is cut, but the burn piles may be undesirable in the campground. Larger pieces of slash could be retained in the campground for traffic control or firewood if the bark was removed within about a month

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after cutting. Slash of all sizes would not be a hazard if bundles were weighted and sunk in the reservoir. This could also increase the habitat for aquatic organisms if it would not conflict with other uses of the reservoir. Slash can also be made unsuitable for pine engraver breeding at any time of year by chipping. There may be some use for the chips in the campground as mulch.

8. Treat stumps with borax. The application of borax (sodium tetraborate decahydrate) to freshly cut conifer stumps is quite effective in preventing the introduction of Fomes annosus. The use of borax following all thinning or cutting operations in developed recreation sites is required by FSM 2331.33.

Alternatives 2 through 8 are not mutually exclusive and may be used in various combinations to meet management objectives.

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